

102220148007

CLAIMS:

1. A method of forming a capacitor comprising:

forming a capacitor storage node layer over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume;

capping at least a portion of the rim by forming a material which is different from the capacitor storage node layer over the rim portion, said material as received at least over the rim portion not functioning primarily as a capacitor dielectric material for the capacitor; and

after the capping of the rim, forming a capacitor dielectric region and a cell electrode layer over the capacitor storage node layer.

2. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material thereover.

3. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material within less than an entirety of the interior volume.

4. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material layer over the substrate and anisotropically etching the insulative material layer.

P000000000000000000000000

1 5. The method of claim 1 further comprising prior to the
2 capping of the rim portion, filling less than the interior volume with a
3 filler material which is present during the capping.

4

5 6. The method of claim 1 further comprising prior to the
6 capping of the rim portion, filling less than the interior volume with a
7 filler material which is present during the capping, and wherein the
8 capping of the rim portion comprises forming an insulative material
9 layer over the substrate and the filler material and anisotropically
10 etching the layer.

11

12 7. The method of claim 1, wherein the forming of the
13 capacitor storage node layer comprises:

14 forming a container into a container-defining material over the
15 substrate;

16 forming a capacitor storage node layer within the container; and
17 recessing the capacitor storage node layer to below an uppermost
18 surface of the container-defining material.

19

20 8. The method of claim 7, wherein the capacitor storage node
21 layer comprises roughened polysilicon.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

AR

9. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

3 forming a container into a container-defining material over the substrate;

5 forming a capacitor storage node layer within the container;

6 recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

8 after the capping of the rim portion, removing at least some of the container-defining material.

11 10. The method of claim 9, wherein the removing of the container-defining material comprises removing said container-defining material selectively relative to the capping material which is formed over the rim portion.

10005547-022220

1 11. The method of claim 1, wherein the forming of the
2 capacitor storage node layer comprises:

3 forming a container into a container-defining material over the
4 substrate;

5 forming a capacitor storage node layer within the container;

6 recessing the capacitor storage node layer to below an uppermost
7 surface of the container-defining material; and

8 wherein the capping of the rim portion comprises forming an
9 insulative material layer over the substrate and anisotropically etching
10 the insulative material layer.

11
12 12. The method of claim 1, wherein the forming of the
13 capacitor storage node layer comprises:

14 forming a container into a container-defining material over the
15 substrate;

16 forming a capacitor storage node layer within the container;

17 recessing the capacitor storage node layer to below an uppermost
18 surface of the container-defining material; and

19 further comprising prior to the capping of the rim portion, filling
20 less than the interior volume with a filler material.

APRIL 26 1998

1 13. The method of claim 1, wherein the forming of the
2 capacitor storage node layer comprises:

3 forming a container into a container-defining material over the
4 substrate;

5 forming a capacitor storage node layer within the container;

6 recessing the capacitor storage node layer to below an uppermost
7 surface of the container-defining material; and

8 further comprising prior to the capping of the rim portion, filling
9 less than the interior volume with a filler material, and

10 wherein the capping of the rim portion comprises forming an
11 insulative material layer over the substrate and the filler material and
12 anisotropically etching the insulative material layer.

13
14 14. A method of forming a capacitor comprising:

15 forming a capacitor storage node layer over a substrate, the
16 capacitor storage node layer having an uppermost rim defining an
17 opening into an interior volume;

18 forming a layer of material over the uppermost rim; and
19 anisotropically etching the layer of material.

20
21 15. The method of claim 14, wherein said etching comprises
22 etching said layer sufficient to leave a portion of the material occluding
23 the opening.

AP

1 16. The method of claim 14, wherein said etching comprises
2 etching said layer sufficient to leave a portion of the material extending
3 into the interior volume.

4

5 17. The method of claim 14, wherein said etching comprises
6 etching said layer sufficient to leave a portion of the material extending
7 into the interior volume and occluding the opening.

8

9 18. The method of claim 14, wherein the forming of the layer
10 of material comprises forming a portion of said layer to contact the
11 storage node layer.

12

13

14

15

16

17

18

19

20

21

22

23

24

અનુભૂતિ

1 19. A method of forming a capacitor comprising:

2 forming a capacitor container received within an insulative material

3 over a substrate;

4 forming a capacitor storage node layer within the container, the

5 capacitor storage node layer having an outer surface;

6 forming a layer of material within less than the entire capacitor

7 container and covering less than the entire capacitor storage node layer

8 outer surface and comprising a material which is different from the

9 insulative material within which the capacitor container is formed;

10 after forming the capacitor storage node layer and the layer of

11 material, forming a capacitor dielectric functioning region which is

12 discrete from the layer of material and operably proximate at least a

13 portion of the capacitor storage node layer outer surface; and

14 forming a cell electrode layer over the capacitor dielectric

15 functioning region and the layer of material

17 20. The method of claim 19 further comprising after the forming
18 of the layer of material, forming encasement structure from the layer
19 of material over an uppermost portion of the capacitor storage node
20 layer outer surface by removing portions of the layer of material.

22 21. The method of claim 20, wherein the removing of the
23 portions of the layer of material comprise anisotropically etching the
24 layer of material.

1 22. The method of claim 19 further comprising prior to the
2 forming of the layer of material, less than filling the capacitor container
3 by providing fill material into the capacitor container.

4
5 23. The method of claim 19 further comprising:
6 prior to the forming of the layer of material, less than filling the
7 capacitor container by providing fill material into the capacitor
8 container; and

9 after the forming of the layer of material, forming encasement
10 structure from the layer of material over an uppermost portion of the
11 capacitor storage node layer outer surface by removing portions of the
12 layer of material.

13
14 24. The method of claim 23, wherein the removing of the
15 portions of the layer of material comprise anisotropically etching the
16 layer of material.

17
18
19
20
21
22
23
24

F000000000000000000000000

1 25. The method of claim 19 further comprising prior to the
2 forming of the layer of material, less than filling the capacitor container
3 by providing fill material into the capacitor container, the fill material
4 having an upper surface elevationally below a portion of the capacitor
5 storage node layer outer surface, and wherein the forming of the layer
6 of material comprises forming the layer of material over the substrate
7 and atop the fill material upper surface, and further comprising after
8 the forming of the layer of material, forming encasement structure from
9 the layer of material over an uppermost portion of the capacitor storage
10 node layer outer surface by removing portions of the layer of material.

11
12 26. The method of claim 25, wherein the removing of the
13 portions of the layer of material comprise anisotropically etching the
14 layer of material.

15
16 27. The method of claim 19, wherein the forming of the
17 capacitor storage node layer comprises forming hemispherical grain
18 (HSG) polysilicon within the container.

19

20

21

22

23

24

28. A method of forming a capacitor comprising:

forming a capacitor container received within an insulative material over a substrate;

forming a capacitor storage node within the container and having an uppermost surface and a side surface joined therewith;

forming a protective cap over the uppermost surface;

forming a capacitor dielectric layer over at least some of the side surface and protective cap; and

forming a cell electrode layer over the side surface of the capacitor storage node.

29. The method of claim 28, wherein the forming of the protective cap comprises forming the cap over a portion of the side surface of the capacitor storage node.

30. The method of claim 28, wherein the forming of the protective cap comprises forming the cap from an insulative material which is different from the insulative material within which the capacitor container is received.

31. The method of claim 28 further comprising prior to the forming of the capacitor dielectric layer, selectively removing insulative material relative to material from which the protective cap is formed.

TOP SECRET - DEFENSE

1 32. The method of claim 28, wherein the protective cap is
2 formed by anisotropically etching a previously-formed layer of material.

3
4 33. The method of claim 28, wherein the protective cap is
5 formed by partially filling the capacitor container with filler material,
6 forming a layer of material atop the filler material, removing portions
7 of the layer of material, and after removing the material portions,
8 removing filler material from within the capacitor container.

9
10 34. The method of claim 33, wherein the portions of the layer
11 of material are removed by anisotropic etching.

12
13
14
15
16
17
18
19
20
21
22
23
24

100-959.P02 A2-9812151345N

1 35. A method of forming a capacitor comprising:

2 forming a container received within an insulative layer, the
3 insulative layer having a generally planar outer surface;

4 forming a capacitor storage node layer received within the
5 container, the storage node layer having an uppermost surface disposed
6 elevationally below the generally planar outer surface;

7 filling a container portion with a filling material having an upper
8 surface disposed elevationally below the uppermost surface of the
9 capacitor storage node layer;

10 forming a layer of material within the container and over the
11 filling material upper surface and the capacitor storage node layer
12 uppermost surface; and

13 removing filling material from elevationally below the layer of
14 material.

15
16 36. The method of claim 35, wherein the forming of the
17 capacitor storage node layer comprises:

18 forming a ~~capacitor~~ storage node layer of material over the
19 substrate; and

20 removing portions of the capacitor storage node layer of material
21 sufficient to recess the capacitor storage node layer to below the
22 generally planar outer surface of the insulative layer.

23
24

GOVERNMENT PROPERTY

1 37. The method of claim 36 further comprising filling the
2 container portion before the removing of the portions of the capacitor
3 storage node layer.

4
5 38. The method of claim 35 further comprising prior to
6 removing the filling material, exposing portions of the filling material by
7 removing portions of the layer of material.

8
9 39. The method of claim 38, wherein the removing of the
10 portions of the layer of material comprises anisotropic etching.

11
12 40. The method of claim 38, wherein the removing of the
13 portions of the layer of material forms a band inside of the container
14 and over the uppermost surface of the capacitor storage node layer.

15
16 41. The method of claim 35, wherein the insulative layer within
17 which the container is received comprises a first material, and the layer
18 of material which is formed within the container comprises a second
19 material, and further comprising after forming the layer of material,
20 removing material of the first material selectively relative to material of
21 the second material and forming a capacitor dielectric functioning region
22 and a cell plate layer over the substrate.

1 42. A method of forming a capacitor comprising:

2 forming a pair of conductive lines over a substrate having a node
3 location with which electrical communication is desired;

4 forming a capacitor storage node layer at least a portion of which
5 is disposed over the node location, the storage node layer having an
6 outside surface and an inside surface spaced inwardly from the outside
7 surface, both surfaces extending away from the node location and
8 terminating proximate an opening into an interior region of the storage
9 node layer;

10 forming a dielectric cap within the opening and covering less than
11 an entire portion of the inside surface, wherein the opening is redefined
12 as a narrower opening;

13 after forming the dielectric cap, forming a dielectric functioning
14 region, discrete from the dielectric cap, over the outside and inside
15 surfaces of the storage node layer; and

16 forming a cell plate layer over the dielectric cap and the
17 dielectric functioning region.

18
19 43. The method of claim 42, wherein the inside surface of the
20 capacitor storage node layer is defined at least in part by hemispherical
21 grain (HSG) polysilicon.

10000000000000000000000000000000

1 44. The method of claim 42, wherein the forming of the
2 dielectric cap comprises forming a layer of dielectric material over the
3 substrate and anisotropically etching said layer.

4
5 45. A capacitor comprising:
6 a capacitor storage node having an outside surface and an inside
7 surface spaced inwardly from the outside surface, the surfaces defining
8 an elongate tubular body having a terminus which defines an opening
9 into an interior region of the tubular body;
10 an insulative band of material disposed adjacent the opening and
11 joined with the terminus of the tubular body;
12 a capacitor dielectric functioning region disposed over portions of
13 the inside and outside surfaces; and
14 a cell plate layer disposed over the capacitor dielectric
15 functioning region.

16
17 46. The capacitor of claim 45, wherein the elongate tubular
18 body includes a central axis, and the band generally tapers along the
19 central axis.

20
21 47. The capacitor of claim 45, wherein one portion of the band
22 is disposed within the interior region and another portion of the band
23 is disposed outside of the interior region.

10052557.0222260

1 48. A capacitor comprising
2 a capacitor storage node comprising a tubular body having an
3 opening into an interior region of the body;
4 a material disposed over the tubular body and occluding a portion
5 of the opening;
6 a capacitor dielectric functioning region disposed over portions of
7 the tubular body; and
8 a cell plate layer disposed over the dielectric functioning region.

9
10 49. The capacitor of claim 48, wherein said material extends
11 into a portion of the interior region.

12
13 50. The capacitor of claim 48, wherein said material has an
14 elevational thickness over the tubular body greater than the thickness
15 of the dielectric functioning region.

16
17 51. A capacitor comprising:
18 a capacitor storage node comprising a tubular body having an
19 opening into an interior region of the body;
20 a material disposed over the tubular body and extending into a
21 portion of the interior volume;
22 a capacitor dielectric functioning region disposed over portions of
23 the tubular body; and
24 a cell plate layer disposed over the dielectric functioning region.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

52. The capacitor of claim 51, wherein said material has an elevational thickness over the tubular body greater than the thickness of the dielectric functioning region.

SEARCHED - INDEXED - SERIALIZED - FILED